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BATS IN SPOTTED OWL PELLETS IN SOUTHERN ARIZONA

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Analyses of regurgitated owl pellets containing undigested hair and bones permit comparison of species of small mammals not commonly found in pellets with those that are. Results suggest interspecific differences in predator avoidance (Kotler 1985). In addition, new locality records have been obtained, and estimates of population density have been possible (e.g., *Notiosorex crawfordi* [Armstrong and Jones 1972]; bat species in the tropics [Allen 1939]).

Because of the absence or low frequency of occurrence in pellets, bats have been considered an uncommon food for most North American owls (Gillette and Kimbrough 1970, Johnsgard 1988, Long and Kerfoot 1963, Marti 1974). Bats have been listed most frequently as prey of Common Barn Owls, *Tyto alba* (Allen 1939, Kunz 1974, Ruprecht 1979).

Previously, bats have been considered a rare prey item of Spotted Owls, *Strix occidentalis* (Marshall 1942, Wagner et al. 1982). In Oregon, for example, bats comprised only 1% of 4,527 prey items (Forsman et al. 1984). In California, Barrows (1987) identified <1% bats in a sample of 1,829 prey items, and in Arizona, only 2% of 1,193 prey items contained bats (Ganey 1988). Here we report the results of additional analyses of Spotted Owl pellets from Arizona.

Sixty-five pellets and additional fragments were collected from a mated pair of Mexican Spotted Owls (*S. o. lucida*) between 1 January and 23 March 1989 in the Huachuca Mountains, Cochise Co., Arizona (Fig. 1). Pellets were obtained beneath roosts in a steep canyon (elev. 1,737–2,134 m) within montane riparian woodland bordered by mixed-conifer forest and Madrean evergreen woodland (Brown 1982). Dead conifer trees in various stages of decomposition were present. Limestone bedrock was frequently exposed, forming broken cliffs >50m high. Small caves and solution pockets were common, and permanent seeps contributed to a perennial water supply. Pellets were cleaned in 2% aqueous solution of sodium hydroxide to permit identification of skeletal contents (Longland 1985).

Unpublished data were obtained from E. D. Forsman (personal communication), who collected 409 prey items in summer 1977 from pellets of 2 pairs of Spotted Owls in the Chiricahua Mountains (Fig. 1). For comparison, J. L. Ganey's (1988 and personal communication) data are included here on bat specimens among 1,193 prey items collected from 29 pairs of Spotted Owls throughout Arizona during 1984–1987.

Pellets that we collected contained skeletal remains of 39 white-footed mice (*Peromyscus* spp.), 34 woodrats (*Neotoma* spp.), 1 cottontail (*Sylvilagus* sp.), 3 Northern Pygmy Owls (*Glaucidium gnoma*), 1 White-throated Swift (*Aeronautes saxatalis*), 1 unknown bird, 1 mountain spiny lizard (*Sceloporus jarrovi*), and 11 bats (Table 1). Bats comprised 12% of the total prey items.

Thirty-five bats, 8.6% of prey items, were identified in Forsman's (personal communication) sample from the Chiricahua Mountains (Table 1). Ganey (1988) listed 24 bats from Spotted Owl pellets (11 from pellets in southeastern Arizona, Table 1) representing 8% of prey items in southern Arizona but only 2% of total prey items of these owls statewide. The presence of three species of molossids, *Tadarida brasiliensis*, *T. macrotis*, and *Eumops perotis* (Table 1), in pellets provides new records for two of the mountain ranges (see Hoffmeister 1986).

A band and skeletal remains of one *Eptesicus fuscus* (a juvenile male banded by R.

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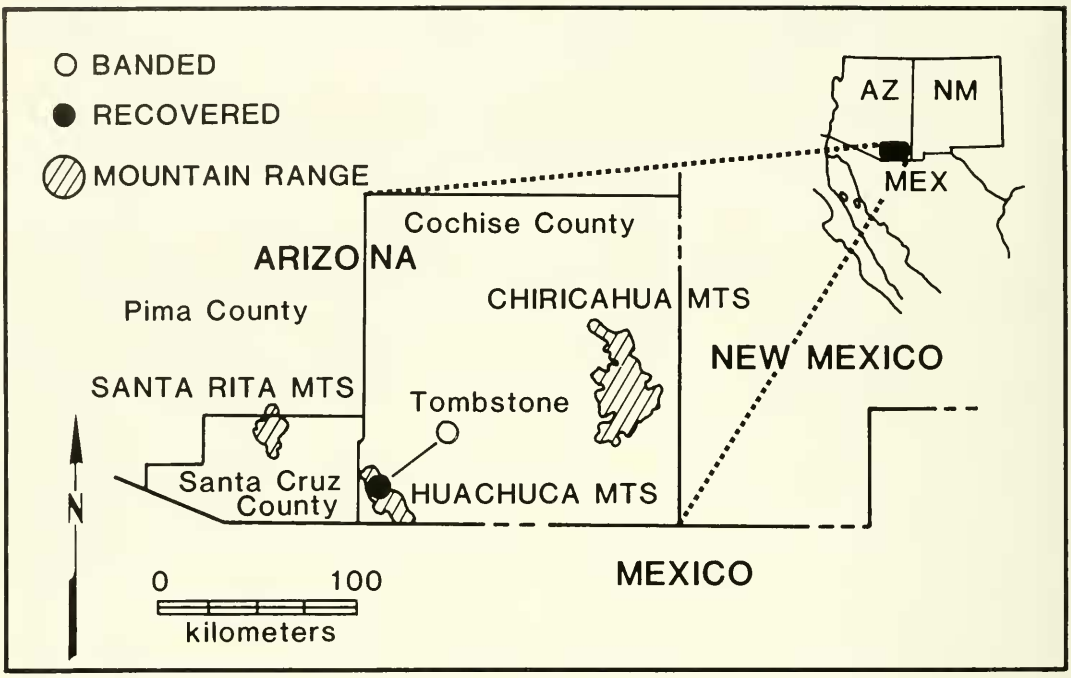

Fig. 1. Huachuca Mountains and surrounding area. Mountain ranges depict relative area above 1,525 m. Locations of banding and recovery sites in Cochise Co., Arizona, are shown for a big brown bat found in a spotted owl pellet.

Sidner and R. Davis on 10 July 1988 at a maternity roost near Tombstone, Arizona) were found in a sample of pellets (dated 7–24 February 1989) from the Huachuca Mountains (Fig. 1). The specimen was found 44 km southwest of the banding site (occupied by bats from May to September only) and is the only off-site recovery of 1,535 banded *E. fuscus*. Because mean home range of mated pairs of Mexican Spotted Owls in northern Arizona is only 847 ha (Ganey and Balda 1989b), recovery of this bat in a Spotted Owl pellet provides information about natural mortality and winter dispersal of *E. fuscus*. It may also suggest the presence of a hibernaculum in the Huachuca Mountains where none is known for this species (Hoffmeister 1986).

Ruprecht (1979) proposed that a high percentage of bat remains occurs among prey items when owl territories overlap home ranges of bats. Pellet analyses have shown that barn owls roosting in the same building with *E. fuscus* consumed a high percentage of these bats (Kunz 1974), while Long-eared Owls (*Asio otus*) roosting in an isolated patch of trees among sand dunes caught only one bat (*Antrozous pallidus*) and 1,365 rodents (Kotler 1985, personal communication). The highest percentage of bats as prey of Spotted Owls was found in our winter sample and reflects the abundance of bat species presumed to have winter ranges in southeastern Arizona (Hoffmeister 1986).

In this study, bats contributed little to total prey biomass of Spotted Owls and simply may have been taken opportunistically. The three species of bats, *E. fuscus*, *A. pallidus*, and *T. brasiliensis*, that were the most numerous in pellets are relatively abundant, colonial species.

Spotted Owls normally employ a sit-and-wait (perch-and-pounce) hunting strategy (Forsman et al. 1984) and are thus unlikely to pursue bats in flight. Mexican Spotted Owls roost and forage in forest adjacent to steep-sided canyons (Ganey and Balda 1989a, 1989b), which provide cool, shaded roosts in trees, cliff ledges, and caves (also used by bats). Owls may take active bats entering or exiting roosts or torpid bats from the interior of roosts (Beer 1953). All bats found in Spotted Owl pellets thus far are species that become

TABLE 1. Bat species from spotted owl pellets in southeastern Arizona. Species are listed for mountain ranges from which the contributors collected pellets. New species records for a mountain range are indicated by *. Numbers in parentheses are individual bats recorded.

Species	Mountain range		
	Chiricahuas	Santa Ritas	Huachucas
Myotis spp.	Forsman (3)		
Myotis californicus (California myotis)			this study (1)
Myotis ciliolabrum (western small-footed myotis)	Ganey (1)		
Lasionycteris noctivagans (silver-haired bat)	Forsman (1)		
Lasiurus cinereus (hoary bat)		Ganey (1)	Ganey (1), this study (1)
Pipistrellus hesperus (western pipistrelle)	Ganey (1)		
Eptesicus fuscus (big brown bat)	Forsman (8), Ganey (2)		Ganey (1), this study (7)
Antrozous pallidus (pallid bat)	Forsman (9), Ganey (1)		
Tadarida spp.	Forsman (1)		
Tadarida brasiliensis (Brazilian free-tailed bat)	Forsman (3), Ganey (2)		*this study (2)
Tadarida femorosacca (pocketed free-tailed bat)	*Forsman (2)		
Tadarida macrotis (big free-tailed bat)	Forsman (4)		
Eumops perotis (western mastiff bat)	*Ganey (1)		
Unidentified bat	Forsman (4)		

torpid during roosting. Bats of this type may benefit beyond energy conservation by selecting darker or less accessible roost sites (Erkert 1982). By comparison, bats that remain alert may stay in the outer, lighted portions of roosts without excessive risk. Two species of bats, Sanborn's long-nosed bat (*Leptonycteris sanborni*) and the Mexican long-tongued bat (*Choeronycteris mexicana*), occur in the three mountain ranges where pellets were collected but do not use torpor or hibernation. Each species hangs alert, making use of lighted portions of roosts (Hoffmeister 1986) and has not been reported from owl pellets collected during any season in Arizona.

Our findings demonstrate that in Arizona, Mexican Spotted Owls utilize a wide vertebrate prey base, suggesting opportunistic foraging as occurs in the northern subspecies (Forsman et al. 1984). Diets may contain a considerable diversity of bats (Table 1), which may be an important component of the winter diet of individual Mexican Spotted Owls in southeastern Arizona.

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